Silvicultural Methods

Tennessee Department of Agriculture, Division of Forestry

Silviculture, or "forest-culture" involves cutting trees in a way that fosters regeneration of fast-growing, well-formed trees of desired species. Silviculture also serves as a tool for managing wildlife, visual values and watershed concerns.

Patch or clearcutting (removing all trees in an area greater than ½ acre) is used to manage species that require full sunlight (red oak, walnut, yellow poplar, yellow pine etc). Exposure to full sun must be maintained through the sapling and pole timber stages.

This method creates forest edge habitat and produces a variety of nutritious wildlife foods. Relatively **small clearcuts** are best for most species. **Relatively large clearcuts** (say, more than 50 acres) are beneficial but sub-optimal for most wildlife.

Owners of large tracts of land might find that a few large clear harvests are easier to manage than many small harvest areas. Larger harvest areas also require fewer miles of access roads, and once an area is harvested it is left undisturbed for decades. Large openings have less timber edge effect (more limbs on the open side) than smaller opening.

Landowners who employ large clear harvest areas should consider leaving wide (100') streamside management zones containing mature trees along perennial streams. These will accommodate most songbirds even where all upslope areas have been clearcut. Leaving 2 or three den trees per acre will accommodate a number of other wildlife species

Harvesting **small groups** (¼ to ½ acre) of trees can regenerate white oak, ash, red maple, cherry and white pine, which are intermediate in shade tolerance. A few less tolerant species may also regenerate toward the centers of openings. While not optimal for timber production, this method provides a good compromise between timber, wildlife and scenic objectives. It is well suited to small ownerships.

Individual tree selection management is suited only to trees that reproduce and grow well in the shade, and oaks on poor dry sites. This excludes oaks on good sites and most other highly desirable trees in the Southeast. The only timber species in this region that can be grown on a sustainable basis using this method are sugar maple (on better sites) and oak (on poor sites).

Maintaining **two ages** of trees at all times in a given stand is an option in oak forests where scenery and certain wildlife species (squirrels, birds) are important considerations.

Thinning is an intermediate cutting method used to increase growth of the "crop" trees. Thinning can be used in any timber management system at the sapling or pole timber stage. *Thinning does not generate a new forest, and it cannot improve a forest forever. Eventually there must be a final harvest and regeneration of new trees.*

Crop tree management is carefully targeted thinning. The manager identifies trees of good form and species on good sties (crop trees) then frees them to grow faster by cutting some of the surrounding trees.

Butt-log forestry is similar to crop tree management. It can produce veneer logs in a relatively short time on prime sites. Seedlings are planted 13 feet apart. When the crowns begin to close, approximately every other tree (the weakest) is removed. Limbs of the crop trees are trimmed to a height of 17 feet.

Modified shelterwood can encourage oak regeneration on good sites. Understory trees and perhaps 10% of the overstory trees are removed to promote growth of vigorous oak seedlings without encouraging competitors such as poplar. When the oak saplings reach about 10 feet in height, the entire overstory is harvested.

High grading or diameter limit cutting, where marketable trees over a given diameter are cut, is <u>not</u> a silvicultural method. High-grading may be less noticeable than clearcutting, but it seldom results in good regeneration. Repeated high-grade logging generally reduces the commercial value of the forest. High-grading has been by far the most common cutting method in the mid-south because it is the most profitable in the short term. There are, however, some situations where high-grading might be appropriate, such as removing a few large over-mature trees from a younger stand, or removing scattered merchantable trees from a streamside management zone.

There is no "best" timber management method. Each has its own purpose, advantages and tradeoffs. Methods can be mixed and hybridized.

Regardless of the silvicultural method used, the landowner should use Best Management Practices or BMPs.

Version 10-05

BOARD FOOT VOLUMES
Standing Tree Lumber Scale
Based on International Rule ¼ Inch Scale

DBH inches	1 log	1 ½ log	2 logs	2½ logs	3 logs	3½ logs	4 logs	4½ logs
10	36	48	59	66	73			
11	46	61	76	86	96			
12	56	74	92	106	120	128	137	
13	67	90	112	130	147	158	168	
14	78	105	132	153	174	187	200	
15	92	124	156	182	208	225	242	
16	106	143	180	210	241	263	285	
17	121	164	206	242	278	304	330	
18	136	184	233	274	314	344	374	
19	154	209	264	311	358	392	427	
20	171	234	296	348	401	440	480	511
21	191	262	332	391	450	496	542	579
22	211	290	368	434	500	552	603	647
23	231	318	404	478	552	608	663	714
24	251	346	441	523	605	664	723	782
25	275	380	484	574	665	732	800	865
26	299	414	528	626	725	801	877	949
27	323	448	572	680	788	870	952	1,032
28	347	482	616	733	850	938	1,027	1,114
29	375	521	667	794	920	1,016	1,112	1,210
30	403	560	718	854	991	1,094	1,198	1,306
31	432	602	772	921	1,070	1,184	1,299	1,412
32	462	644	826	988	1,149	1,274	1,400	1,518
33	492	686	880	1,053	1,226	1,360	1,495	1,622
34	521	728	934	1,119	1,304	1,447	1,590	1,727

Crop Tree Release

Tennessee Department of Agriculture, Division of Forestry

Crop tree release (CTR) provides a way for landowners to increase the growth rate of trees, reduce the time needed for trees to reach marketable size, increase timber quality, improve wildlife habitat, and at the same time protect and improve the appearance of the forest.

Select good sites – deep, loamy, well-watered but well drained - where your efforts can pay off. Good sites are usually found on well-drained bottomlands, along streams, in coves, on north and east slopes, and on concave landforms. Use NRCS soil maps and/or look for

- presence of tree and understory species usually found on good sites
- tall straight tree trunks
- smooth, thin, tight bark on young timber

Determine if the trees are big enough (at least 4" diameter breast height).

Define your objectives: timber? wildlife? appearance?

Group species according to their desirability for meeting the objectives. A suggested list:

Timber – desirable:
oak, tulip poplar, ash, cherry, walnut, paulownia

Timber – acceptable:
maples, persimmon, hickories, beech (if sound)

Timber – unacceptable:
Blackgum, sweetgum, buckeye, sourwood, hollow beech, locust, elm

Desirable for wildlife:
Oak, beech, persimmon, maple, dogwood, white pine, blackgum, hickories (except bitternut), black walnut

Desirability for wildlife depends on the needs of the wildlife species you want to benefit.

Managing for a diversity of tree species has several advantages: it benefits a wider variety of wildlife, reduces susceptibility to insects and diseases, and allows for changes in the timber market.

Choose crop trees. Walk through the woods, stopping every 35 feet. Imagine you are in the center of a 35' square, then determine which tree in that square, if any, will be the crop tree, and mark it. Upon reaching the forest boundary, start another line of plots; continue until all the land is traversed and crop trees are marked.

Criteria for timber crop trees:

- desirable or acceptable species
- good form – not bent or forked in first 17 feet
- clear trunk with few knots
- top is part of upper forest canopy
- no big dead branches, holes or wounds
- appears to be fast growing – branches in crown reach upward like long slender fishing poles

If there are less than 18 crop trees per acre, CTM may not be justified. Consider harvesting groups of trees and regenerating the forest.

If wildlife and aesthetics are objectives, then trees meeting those needs could be considered as crop trees even if they are not suitable for timber.

Deaden all trees with crowns touching the crop tree crowns (on at least three sides). Do not deaden other trees – they will help protect crop tree trunks from wind damage and epicormic branching (sprouting of new branches from the trunk).

Trees can be deadened either by girdling with a chainsaw (cut two rings around the trunk at least 6' apart and at least ¾" into the wood) or by frilling with an ax and applying a solution of appropriate herbicide (Accord, Garlon, Tordon). Deadened trees will provide snag habitat for wildlife. It is normally not feasible to remove these trees for sale.

Tree growth and wildlife food production should increase substantially following crop tree release (studies show roughly 40 to 80% greater diameter growth). The increase in dollar value is even greater, due to increases in log grade.

Other cultural practices Grapevines can damage trees by blocking sunlight and by breaking the tops during ice storms. Deaden any vines you don't want for wildlife by cutting vines and applying a 25% solution of glyphosate (brand name Accord or Roundup).

Pruning limbs up to a height of 17 feet will improve log grade more quickly.

Fertilizing with nitrogen and lime increases growth substantially. Scatter between 3 and 9 lbs. of ammonium nitrate (2-6 lbs. urea) over a 25-foot diameter circle centered on each crop tree during the first March after release.

Harvesting groups of a dozen or more crop trees will open up the forest enough for new trees to grow. Harvesting groups of trees also reduces damage to standing timber. Non-crop trees in the harvest area should be deadened.

Version 11-01

Enhancing Forest Beauty

Tennessee Department of Agriculture, Division of Forestry

Most landowners place a high value on the beauty of their woods. The natural beauty of the forest can be enhanced. Wildlife/ timber management can contribute by increasing diversity and interest.

Variety (many species and ages of trees, contrasting stands, openings.) Diversity in vegetation also promotes diversity in wildlife.

- Conduct small timber harvests using different techniques: small "clear-cuts" (all species), two-age cutting (oak), single tree harvest (sugar maple))
- Plant trees and shrubs, including some evergreens
- Leave snags and den trees
- Leave trees along streams and bluffs
- Maintain small food plots
- Create gradual transitions from forest to openings

Special features, points of interest: ponds, springs, streams, wildlife observation blinds, old house sites, cemeteries, bluffs, caves, shady coves, open park-like stands, overlooks, vistas, big interesting trees.

- Leave trees near water
- Build trails for access
- Install park benches
- Locate wildlife viewing points at forest edges and streams
- Fertilize, lime and remove competitors around selected trees to increase their growth;
- Develop park-like stands by favoring maple, beech, basswood and white pine (on good sites); prune branches (to 17' to increase timber value); under-burn pine stands

"Placeness" and **privacy.**

- Plant hedges, (especially curving evergreen hedges)
- Maintain contrasting types of forest and openings
- Lay out curving trails that lead from one "place" to another
- Locate trails and roads along boundaries between different types of vegetation to accentuate their differences
- Build "places" around special features
- Use converging and diverging lines of vegetation along trails to draw attention into and out of the woods, or to a feature.
- Use terrain features: hilltops, north slope in summer, south slopes in winter

Special places are a key to enjoying your forest. You can enjoy them while reaping the benefits of more intensive management (wildlife habitat improvement, timber production, leasing) elsewhere on your property.

Wildflowers

- Many species will colonize if their habitat is provided.
- Native wildflowers can be planted in appropriate sites.
- Threatened and endangered (T&E) plants should be purchased *only from a nursery with a T&E license.*
- Bogs and streamsides sometimes harbor unusual wildflowers.

Plant favorite trees, shrubs and flowers around ponds, clearings, along trails and near park benches.

Trees with spring flowers: redbud, dogwood, sourwood, catalpa, paulownia, serviceberry, tulip poplar, crabapple, hawthorn, buckeye, yellowwood, black locust, red maple.

Fall color: ash, blackgum, poplar, sassafras, sugar maple, red maple, pignut hickory, dogwood, sourwood, sumac and sweetgum; oak varies considerably. Pine resin adds fragrance to fall air.

Winter: holly, pine, cedar, hemlock (green, windbreaks); crabapple, hawthorn, dogwood (berries) sycamore (bark, fruit), sassafras and other trees with interesting branches

Where timber is harvested:

- Clear harvest only small areas.
- Consider creating a two-age stand.
- Plan and flag in roads and skid trails to minimize damage to soil and residual trees.
- Cut low stumps.
- Mark "bumper trees" at bends in skid trails to protect other trees as logs are dragged past (remove the bumper trees last.)
- Chop or pile logging debris. Piles of branches provide cover for wildlife.
- Leave trees along roads, ponds, springs and streams. Trees left along roads can be cut after new trees have grown.
- Grade and re-vegetate roads and skid trails.
- Don't log when the soil is wet
- Mark anything you want left or protected.
- Specify all protection measures in a logging contract.
- Choose a logger with a good reputation.
- Mule logging and feller/buncher machines might disturb the ground less than conventional skidders. Ask your consulting forester.

After one growing season, the harvest site will be covered with natural seedlings. For more information, see www.ncsu.edu/ncsu/forest_resources/desktop/woodscaping

Version 5-01

Firewood

Tennessee Department of Agriculture, Division of Forestry

Forest owners can convert leftovers from thinnings, improvement cuttings, or commercial harvests into firewood. They have the option of selling on a "you-cut" basis, cutting and selling on-site, selling to (or at) a firewood lot, or delivering to the customer.

Buyers can get the best price by shopping around. "Want adds", yellow pages, bulletin boards, word of mouth, or roadside signs are means of finding and advertising firewood. Some landowners, utilities, landfills, wood products industries and state forests will let "do-it-yourselfers" cut wood for a fee.

Dense or heavy woods such as hickory and oak burn long at a sustained rate and contain the greatest amount of energy per cord. ***Light woods*** provide a quick bright fire. They contain only ½ to 2/3 the energy of heavy woods and should be priced somewhat lower.

Yellow pine contains pitch that burns hot but is sooty. Yellow pine and especially **cedar** pop a lot, which can be enjoyable and safe behind glass fireplace doors.

Oak, beech, **ash and hackberry** are good, easy-to-split firewoods. **Sycamore, blackgum and elm** are almost impossible to split by hand. **Hickory** is difficult to split, but it and **sugar (hard) maple** make good beds of coals.

Firewood is sold by the ***cord, rick*** and ***pickup load***. A **cord** is a stack of wood 4'wide, 4' high and 8' long. A **rick** is a fraction of a cord. An 8'x4'x24" rick contains ½ cord. A rick of 16" pieces is 1/3 cord. A load in a full-sized pickup can vary from 1/3 to ½ cord, which is 1 to 1½ ricks of 16" wood. A cord of heavy wood weighs about 2 tons cured and 3 tons green.

A rick might be stacked loosely or tightly. Small round pieces should fill the voids between large round pieces, and split pieces should fit closely. Unless the price is right, avoid firewood made up mainly of small limbs, which make for a loose rick and a lot of bark. Avoid knotty pieces that are too big for your fireplace or stove. Cover stacks to keep wood from deteriorating. Two to three cords will usually last a winter.

Wood should be air-dried for at least 6 months, and preferably 9. Well-cured firewood is grayish on the end, with radial cracks. "Green" wood is difficult to light, burns cool, smokes a lot, and can leave deposits of tar in the chimney that can cause dangerous flue fires. Those who burn uncured wood might need their chimney swept often. Woodcutters can speed up curing by felling and leaving trees in summer. The leaves will draw much of the water out of the wood.

Heat content (million BTU/chord), 20% moisture:

Hickories	30.8-32.1
Oak:	
willow, swamp white	29.6-30.8
post, scarlet, swamp chestnut	28.7
chestnut, southern red, white	28.3
northern red, overcup, water	27.0
black	26.1
Locust, black	28.3
Beech	27.4
Maple, sugar	27.0
Elm, rock	27.0
Ash, white	25.7
Walnut, black	23.6
Maple, red	23.2
Sweetgum	22.3
Hackberry	22.1
Pine, yellow	21.8
Cherry, black	21.4
Elm, American	21.4
Sycamore	21.0
Yellow-poplar	18.0
Sassafras	17.5
Cottonwood	17.1
Hemlock	17.1
Willow	16.7
Pine, white	15.0

Firewood can be difficult to identify. With some practice, a simple "heft test" can distinguish dense from light firewood.

Measuring Tree Volume

Tennessee Department of Agriculture, Division of Forestry

1) Measure the circumference 4 ½ feet above the ground and use the conversion table:

Circumference	Diameter	Circumference	Diameter	Circumference	Diameter
37.75 (3′ 1 ¾″)	12″				
40.75 (3′4 ¾″)	13	66.00 (5′ 6″)	21	100.50″ (8′4″)	32
44.00 (3′ 8″)	14	69.00 (5′ 9″)	22	103.50″ (8′7 ½″)	33
47.00 (3′ 11′	15	72.25 (6′ ¼″)	23	106.75″ (8′10 ¾″)	34
50.25 (4′ 2 ¼″)	16	75.25 (6′ 3 ¼″)	24	110.00″ (9′ 2″)	35
53.25 (4′ 5 ¼″)	17	78.50″ (6′ 8 ½″)	25	113.00″ (9′ 5″)	36
56.50 (4′ 8 ½′)	18	81.50″ (6′ 11 ½″)	26	116.25 (9′ 8 ¼″)	37
59.50 (4′ 11 ½″)	19	84.75″ (7′ ¾″)	27	119.25 (9′ 11 ¼″)	38
63.75 (5′ 2 ¾″)	20	88.00″ (7′ 4″)	29	122.50 (10′ 3 ½″)	39
		91.00″ (7′ 7″)	30	125.50 (10′ 6 ½″)	40
		97.25″ (8′ 1 ¼″)	31		

2) Measure tree height. Stand 50 feet from the tree. Hold a yardstick upright 25″ from your eye; align bottom end of stick with the bottom of the tree. Without moving the stick, look up and note which inch mark lines up with the merchantable top. On hardwoods the merchantable top is 10″ in diameter or to the first major limb. Each inch on the stick equals two feet of tree height. Round your merchantable height down to the nearest 16 foot log or 8 foot half log. For example, 36 feet is rounded down to two logs (32 feet).

3) Look up volume. Volumes are International ¼ inch rule.

Diameter	1 log	1 ½ logs	2 logs	2 ½ logs	3 logs	3 ½ logs	4 logs	4 ½ logs
12″	56	74	92	106	120	128	137	
13	67	90	112	130	147	158	168	
14	78	105	132	153	174	187	200	
15	92	124	156	182	208	225	242	
16	106	143	180	210	241	263	285	
17	121	164	206	242	278	304	330	
18	136	184	233	274	314	344	374	
19	154	209	264	311	358	392	427	
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22	211	290	368	434	500	552	603	647
23	231	318	404	478	552	608	663	714
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26	299	414	528	626	725	801	877	949
27	323	448	572	680	788	870	952	1,032
28	347	482	616	733	850	938	1,027	1,114
29	375	521	667	794	920	1,016	1,112	1,210
30	403	560	718	854	991	1,094	1,198	1,306
31	432	602	772	921	1,070	1,184	1,299	1,412
32	462	644	826	988	1,149	1,274	1,400	1,518
33	492	686	880	1,053	1,226	1,360	1,495	1,622
34	521	728	934	1,119	1,304	1,447	1,590	1,727

35	555	776	998	1,196	1,394	1,548	1,703	1,851
36	589	826	1,063	1,274	1,485	1,650	1,814	1,974
37	622	873	1,124	1,351	1,578	1,752	1,926	2,099
38	656	921	1,186	1,428	1,670	1,854	2,038	2,224
39	694	976	1,258	1,514	1,769	1,968	2,166	2,359
40	731	1,030	1,329	1,598	1,868	2,081	2,294	2,494

Regenerating Oak on High-Quality Sites: Midstory Removal

Tennessee Division of Forestry Division of Forestry

Regenerating oak on highly productive sites poses a problem because faster growing species, especially yellow poplar, overtop and shade oak seedlings and sprouts. Oaks tolerate and grow in moderate shade for the first 10 years or so of life, but if they remain in the shade they will become stunted or die.

The objective of midstory removal is to create the light conditions that encourage oak advance regeneration to grow faster than competing species.

The first step in regenerating oak on good sites is to ensure that oak seedlings and sprouts are already present. The next step is to remove the midstory so that enough light is let through to allow these seedlings to grow vigorously, but not so much light that poplar and other competitors take over. The midstory is composed of trees whose tops do not reach the height of the main canopy. Midstory species can include sapling-sized red maple, dogwood, hickory, hornbeam, sourwood, black gum, and beech.

Do not remove any trees from the main canopy. This would let in too much light and encourage unwanted competition. Likewise, do not remove any midstory tree that would uncover a gap in the canopy.

Midstory trees should be killed with herbicide applied by frilling or by basal streamlining. To frill, chop around the tree trunk and apply herbicide to the wounds. Basal streamlining is spraying a stream of ground-active herbicide around the base of each tree. Use appropriate herbicides labeled for each type of application.

Remove overstory trees in one or more cuttings once the oak gets big enough to stay ahead of competing seedlings. This is usually five to ten years after midstory removal, when the seedlings are about 10 feet tall.

Version 7-04

Natural Regeneration

Tennessee Department of Agriculture, Division of Forestry

There is seldom a need to plant hardwood seedlings. Nature usually provides too many new trees – up to 10,000 per acre! We can guide this process to favor a desirable mix of species with good form and vigor.

Forest regeneration (new trees) comes as seedlings, stump or root sprouts, and as "advance regeneration."

- Seeds of some species can lie dormant on the forest floor for several years. Species that commonly regenerate from seed include yellow poplar, ash, maple, elm, sweetgum and sycamore. Seedlings often take a while to become established and begin rapid growth.
- Sprouts from stumps and roots are the most common means of regeneration in Mid-South forests. Sprouts grow from dormant buds at the base on the tree or on major roots. Oaks especially regenerate this way. Sprouts grow quickly because they draw on food stored in a large root system that formerly supported an entire tree. Advance regeneration includes any viable seedlings or saplings already present in the forest. Oak must be at least 4.5' tall and 1" in base diameter before it can compete successfully.

To get good natural regeneration

- Provide **sunlight.** Oak and most other highly--desirable timber and wildlife species must have pretty much full sun to do well.
- Cut low stumps. High stumps can introduce decay into the sprout. Sprouts emerging from roots and from low on the stump chemically seal themselves off from decay.
- Deaden all but the best sprout on each stump, either by cutting or by girdling
- Cut or deaden cull trees

Deaden unwanted sprouts of ***desired*** species by cutting a 2" wide band through the outer bark and cambium (slick layer).

Deaden sprouts of ***unwanted*** species by spot spraying with Tordon, Velpar or Accord, or by the "hack and squirt" method, where wounds are made around each sprout and squirted or painted with herbicide.

Oak may appear to be scarce in the dense sapling stage, but within 10-20 years many competitors will drop out, leaving a more prominent oak component. Poplar may be very plentiful at first but tends to succumb to droughts on drier sites.

Growing oak on good sites is problematic. Intensive clearing of competitors is one option. Securing advance regeneration is another. This can done by a modified shelterwood, where the midstory trees and 10% of the canopy is removed. This should provide enough sunlight for oak advance regeneration to develop. When it reaches 5-10 feet tall, the remainder of the stand is harvested. This technique is based on the fact that oak seedlings are fairly tolerant of shade until they reach sapling size.

Version 7-01

Prescribed Fire

Tennessee Department of Agriculture, Division of Forestry

Fire has always been an important part of our ecosystem. Until a few decades ago it was widely used (and misused) as a tool in managing rural land. Since then, land use and attitudes have changed a great deal. Fire is largely absent and is often frowned upon. Yet prescribed fire is a valuable tool for farm and forest managers. More widespread use of prescribed fire could:

- improve habitat for quail, turkey, deer and other wildlife
- allow fire dependent flowers, grasses and trees (such as the increasingly rare table mountain pine) to regenerate
- reduce wildfire risk
- improve the looks and manageability of pine stands

Agricultural burning is used to dispose of stubble and to maintain warm-season grass pastures and wildlife food plots. This is the easiest type of prescribed burning, and is of most interest to landowners.

Prescribed fire benefits deer, turkey, quail and other birds by regenerating nutritious browse, increasing the number of food insects, clearing the ground between grass clumps, and favoring legumes.

Under-burning in pine stands reduces wildfire hazard, increases visibility and ease of access, and improves habitat for turkey, quail and deer. It can also help regenerate oak, but this is still experimental and is not recommended, as it easily damages hardwood timber. Pines should be at least 5" diameter at breast height and 30' tall (normally about 10 years old.) Strive for a slow, backing fire (flames burning away from unburned fuels) during cool weather. Beware of dry vines, cedars, needles, fallen trees etc. that can carry flames into the tree tops. A cautious novice with plenty of help should be able to safely under-burn an open pine stand on gentle terrain.

Slash burning is one way to prepare cut-over land for tree planting, and to reduce fire hazard. It is usually more difficult than field burning or under-burning, and is best left to someone with considerable knowledge and experience.

There are alternatives to slash burning. Perhaps your land can be planted despite the slash. Ask a forester or tree planting contractor.

When considering whether to use prescribed fire, a landowner should ask

- What do I want to accomplish?
- What are my alternatives?
- What are the costs and risks of each option?

Reliable debris burning contractors are available in many areas. In some locales, Forestry Division crews might also be available for a fee to construct firebreaks and sometimes to do the burning.

Burn in winter or early spring when the fuel moisture and weather are right. Leaves, grass and weeds, and small branches should be dry, but the soil and interiors of large branches should be moist. Burn native warm season grasses prior to their second growing season.

Winds should be light and steady. Light winds may be desirable or even necessary to "carry" the fire in humid fuels. Burning when there is a thermal inversion (stagnant air) can prevent smoke from rising and dispersing as it should. A good time to burn is often the day following passage of a front, when winds are light and uniform and the weather is cool.

Strong winds are dangerous. They can quickly increase fire intensity and rate of spread. Embers

whipped up by the wind can start spot fires, and shifting winds can cause a fire to explode in a new direction. Stop if a strong wind comes up, even if you have a permit.

Wind can be your greatest problem or your greatest asset. Winds are especially strong and shifting when a cold front is approaching. Watch the weather and weather patterns. You can keep informed by purchasing an inexpensive radio tuned to the NOAA weather channel. (Available at many electronics stores.)

Call your local Forestry Division office to get a free **burning permit**, issued over the phone. Permits are required October 15 to May 15 (sometimes longer). **Notify your neighbors** (required by law) and local fire department.

Cut a firebreak all around the area to be burned. It must be to mineral soil, at least 2 feet wide in leaves and short grass, or at least 5 feet wide through tall grass and brush.

Have the **right equipment and enough help.** For easy jobs such as burning game strips or food plots, you should have hand tools, water and several people as a minimum. For larger or more difficult jobs, a dozer or tractor, water truck with a pump, and plenty of hands are highly recommended. "Fusees" – emergency flares – are good ignition sources.

Begin in a "test corner" where you can safely observe fire/smoke behavior and easily put the fire out if it doesn't burn as expected.

Set the fire in narrow strips (about 20-30 feet apart on gentle slopes and light fuel, closer in heavy fuels and on slopes), working ***DOWNHILL*** *and* ***INTO THE WIND.*** Don't light more at one time than you can handle.

Think safety. Have escape routes planned, don't get trapped, watch the weather, don't hurry.

Don't leave until the fire is **out** (no smoke) and **check the surrounding area** for spot fires.

Control smoke

- Burn on days when smoke will rise and disperse. If the smoke hangs near the ground, burn in small blocks.
- Estimate smoke dispersion by plotting lines downwind at 45 degree angles from the *edges* of the burn. Strip-burning of light fuels can noticeably affect locations 5 miles away, and night smoke drainage can affect locations 2-3 miles away in valley bottoms. **Do not burn if critical areas, such as highways, are within ½ mile of a light burn (further for a heavy slash burn.)** These are minimum guidelines. Use good judgement!
- Start early to reduce night smoke drainage.
- Dirty windrows of slash tend to smoke a long time; piles burn faster.
- Mop up along roads first to reduce safety hazard and visual impact.
- Smoke tends to flow down drainages at night. Be aware of roads and houses that this might affect. Try to finish burning 2 hours before sunset.
- Have an emergency plan if weather suddenly changes; be able to extinguish the fire.

Keep in mind that an escaped fire can result in

- Citation for reckless burning
- Payment of fines, suppression costs, court costs and damages to adjacent landowners
- Bad feelings between you and neighbors
- Lawsuits from accidents resulting from smoke obscuring a highway
- Loss of a valuable management tool

These dangers should not discourage landowners from conducting simple prescribed burns, so long as they follow the steps outlined in this bulletin. On the other hand, it is highly advisable to leave slash burning or difficult under-burning to foresters or reliable contractors.

Version 7-01

Pruning Timber Trees

Tennessee Department of Agriculture, Division of Forestry

Pruning can be used to produce a valuable straight knot-free butt log, but it is worthwhile only with fast-growing, high-value species such as walnut and cherrybark oak growing on the best sites.

- Begin pruning at about age five.
- The best time to prune is in February or March.
- Never remove more than 1/3 of limbs or ½ of the crown.
- Don't cut opposite branches in the same year.
- Try to cut branches when they are less than two inches in diameter.
- Don't apply wound dressing.
- Leave the limb collar on the trunk but leave no stub. Note the branch bark ridge on top of the limb and the branch collar on the lower side of the limb. The cut should be made just outside of the branch ridge (on top of cut) and the collar (bottom of cut), so as to leave no stub, nor flush cut.
- Avoid tearing the bark when cutting larger limbs. Remove larger limbs by making three cuts:
    1. first cut on the bottom of the limb from underneath about 12 inches from the branch attachment (about on half way up through the limb),
    2. then cut down from the top of the limb about one inch from the under cut (also about half the way through),
    3. finally, cut just outside the branch bark ridge and the outer portion of the collar to remove the stub.
- If the amount of pruning needed to produce a suitable tree is just too drastic, it might be preferable to cut down the tree at 4 inches above the ground (at a 30 degree angle) and allow the best resulting stump sprout to form a new stem.
- Prune all limbs to a height of 17 feet.

When there are two leaders, leave the straightest one. If a leader is less than 45 degrees off vertical, it can be straightened by duct taping it toward an opposite limb (note: it will naturally tend to bend more toward the south).

If limbs of young trees begin to overlap, the stand needs to be thinned. Crowding cannot be corrected by pruning.

Version 12-01

Road Construction

Tennessee Department of Agriculture, Division of Forestry

Roads can vary from a simple dozer trail to a graveled, cross-drained all-weather road in rough terrain. The following information should be sufficient for average circumstances. Special skills and experience might be needed in constructing roads in more difficult situations.

Specifications for road construction should be written into contracts so that the roads are an asset to the property rather than a liability.

The first step is to flag a trial road centerline. Keep the grade below 10%. Stay as far from streams as possible. Do not put the road directly on a ridgetop, but on the ridge shoulder where it can drain. Critical "control" points might determine the route of the road. These could include wet areas, creeks, rock outcrops, or a location for a switchback. If switchbacks or similar sharp turns are needed, construct them on a 60-foot radius to the centerline.

The initial dozing should have few cuts and fills and might remove as little as six inches of soil. Push debris to the downhill side, where it will catch sediment that washes off the road.

On subsequent cuts install broad-based dips every 140 to 300 feet, depending on the steepness of the road grade. Broad-based dips are built into the road grade by backsloping at 3%. These dips are in effect a rolling of the road grade. Dips and wet areas should be armored with 3" gravel.

Outslope or inslope the surface at 3% (1/4 inch per foot.) This will remove water from the surface and prevent erosion. On flat ground, crown the road at 3%. Inslopes should be used where a slippery surface could create a safety hazard. Culverts or open-topped log cross drains will be needed to drain ditches of insloped roads.

Make the final road surface at least 12 feet wide. Balance fills and cuts, and try to minimize disturbance. This will save money and reduce soil movement. Construct several months in advance to allow fill to settle. Do not use topsoil as fill.

Avoid constructing in wet weather. Avoid crossing streams. Where streams must be crossed, do so at a right angle. Refer to state Best Management Practices guidelines for appropriate crossing structures. Where the road follows an old road grade, disturb the surface as little as possible.

Flag skid trails prior to logging. Locate them on the contour to the extent possible. Keep the grade below 10% (short stretches of up to 30% are acceptable.)

Water bars should be installed on skid trails and temporary roads when the sale is finished. They should be 8-12 inches deep and angled to the downhill side about 30 degrees. Spacing of waterbars depends on slope and soil type, but a general guide is:

5%	125′
10%	80′
15%	60′
20%	50′
25%	40′

Sow exposed soil to grass, using a rate of 30-40 lbs./ac fescue and 60 lbs./ac wheat between early March and mid-April, or mid-August to mid-October. Late sowing (May – early June) can be done with 30 lbs./ac sericea lespedeza.

Version 12-01

Seeding Roads and Landings

Tennessee Department of Agriculture, Division of Forestry

Seeding log landings, skid roads, retired roads, and road banks can

- Protect valuable soil from eroding
- Protect water quality in streams
- Improve the looks of a logging site
- Create prime wildlife cover and feeding areas for turkey, quail, grouse, rabbit and other animals
- Create travel lanes for wildlife
- Stabilizes roads for recreational use

Rip compacted areas with a single-shank subsoiler (50hp tractor required), then seed using a mix of any of the following (be sure to maintain proportions that add up to give full coverage):

Perennials

Fescue	20 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Orchard grass	18 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Clover	4 lb/ac mid-February through mid-May
Lespedeza	12 lb/ac mid-February through mid-May
Perennial rye	25 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Crown vetch	5 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Prairie grasses	7-10 lb/ac mid-May through mid-June
Partridge pea	14 lb/ac mid-March through mid-May

Annuals

Sorghum	45 lb/ac mid-April through mid-June
Wheat	50 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Timothy	8 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May
Buckwheat	40 lb/ac mid-August through mid-October *and*/*or* mid-February through mid-May

Keep seed from washing away.

- Pre-plan roads so they are not too steep, and flag them. Good roads are a permanent investment that can be used far into the future.
- Maximum grades might be 10% in soils that are relatively resistant to erosion, such as clays and cherty soils, and only 3% or so in highly erosive soils, such as West Tennessee silts and silt loams.
- Be sure roads are well drained so that water can flow off the road rather than down it. A very effective drainage method is to "out-slope" the road grade.
- Take advantages of terrain features that can serve as natural drains.

After timber harvest is complete, lime (~ 2 tons per acre) and fertilize (~ 500 lb./ac 6-12-12 or 250 lb/ac 12-24-24). Disking the seed in is optional. If the soil is loose, dry and dusty, rain will mix the seed in. Sticks and other logging debris left on the site will help hold the seed and prevent erosion.

Seedling Care

Tennessee Department of Agriculture, Division of Forestry

Transport

Transport in a covered vehicle to prevent exposure to direct sunlight.

Place spacer sticks between layers of bags to promote air circulation.

Leave an air space between the top-most bag and the sun-cover of vehicle to prevent overheating.

Transport seedlings in the cool part of the day.

Park only in the shade.

Do not transport seedlings when the temperature exceeds 85 degrees, or is below 30 degrees.

Unload seedlings promptly upon arrival.

Inspect bags for tears. Patch holes and tears immediately with tape.

Storage

Seedlings are highly perishable. Protect them from overheating, freezing and drying

Store seedling packages in a cool shaded location where there is little fluctuation in temperature, such as: basement (away from furnace), crawl space under house, barn or shed, springhouse, cellar.

Place spacer sticks between packages to provide adequate ventilation; leave space between package and wall, floor or ceiling.

Do not open bags until ready to plant. Seedlings do not require watering so long as bag remains closed.

Bags NOT sealed at the top need to be watered every 2-3 days. Water using a trickle of water, then drain off excess.

Culling and Root Pruning

Open only one bag at a time.

Keep root exposure to an absolute minimum (less than one minute). Cover the roots with a moist cloth. Work with only a handful of seedlings at a time.

Discard all seedlings that have

- Sour smell
- Mold on needles or stem
- Root collar diameter of less than 1/8″
- Stems that are not stiff and woody
- No mature needles (needles do not occur in bundles)

Prune excessively long roots. Do not prune too much; roots must be at least 5″ long.

Do not remove more than half of the lateral (side) roots.

Use a sharp instrument to prune with. Do not tear roots.

Keep roots visibly moist at all times.

Volume Tables – Doyle Rule

Tennessee Department of Agriculture, Division of Forestry

	Number of 16 foot logs				
	1	2	3	4	5
diameter					
10	14	20	22		
11	22	32	38		
12	29	43	53	56	
13	38	59	73	80	
14	48	75	93	103	
15	60	96	121	136	
16	72	116	149	170	
17	86	140	182	209	
18	100	164	215	248	
19	118	194	256	297	
20	135	225	297	346	383
21	154	260	344	404	452
22	174	295	392	462	521
23	195	332	444	522	594
24	216	370	496	582	668
25	241	414	558	660	758
26	266	459	619	737	849
27	292	505	684	814	940
28	317	551	750	890	1032
29	346	604	824	980	1142
30	376	658	898	1069	1251
31	408	717	983	1176	1370
32	441	776	1068	1283	1488
33	474	835	1152	1385	1609
34	506	894	1235	1487	1730
35	544	964	1334	1610	1876
36	581	1035	1434	1732	2023
37	618	1102	1534	1854	2172
38	655	1170	1635	1975	2322